Conference Reports

CONFERENCE ON PRECISION ELECTROMAGNETIC MEASUREMENTS

The 15th Conference on Precision Electromagnetic Measurements, CPEM '86, was held from June 23 to June 27, 1986, at the National Bureau of Standards' Gaithersburg, MD, location. This conference, permanently cosponsored by the NBS, the IEEE Instrumentation and Measurement Society, and the International Union of Radio Scientists (URSI), is held every two years, alternately on the North American continent and elsewhere in the world. It provides an international forum for engineers and scientists responsible for the development of standards, instrumentation, and techniques for the measurement of electromagnetic quantities across the entire frequency spectrum at the highest possible levels of accuracy.

The keynote address was delivered by Norman F. Ramsey, Higgins Professor of Physics, Harvard University. In his talk, entitled "Quantum Mechanics and Precision Measurements," Ramsey reviewed the tremendous improvements in the accuracies of standards, progress in the understanding of basic physical processes, and increases in measurement compatibility made possible by quantum theory. Quantum mechanics has made possible standards based directly on underlying atomic parameters and fundamental physical constants. The adaptation of these standards in the place of artifact standards has led to an increase in accuracy of 4 orders of magnitude over the past 50 years.

Ian K. Harvey of the National Measurement Laboratory, CSIRO, Australia, was presented the IEEE Morris E. Leeds Award for his contributions to the use of superconducting phenomena for precision measurements. Mr. Harvey spoke on "The Development of the Australian Voltage Standard" following his acceptance of the award. The award was presented by Bruno O. Weinschel, president of the IEEE, who also spoke briefly, following Mr. Harvey's talk, on the responsibilities of governments and national standards laboratories vis-a-vis the balance between science and engineering work in the measurements field.

The opening plenary session ended with brief talks by Per O. Lundbom, Stefan Hahn, and Pierre Giacomo, addressing the assembled conferees on behalf of the International Electrotechnical Commission (IEC), the International Union of Radio Scientists (URSI), and the International Bureau of Weights and Measures (BIPM), respectively.

One of the highlights of the conference came on Tuesday morning when the 1985 Nobel Physics Laureate, Klaus von Klitzing, spoke on "Historical Aspects of the Quantum Hall Effect" in a plenary session. His review of the work that led to his discovery of the quantized Hall effect in 1980 provided an excellent coverage of experimental and theoretical work in the field of two-dimensional electron gases. His talk was not without—von Klitzing showed also how his career and momentous discovery had been forecast by astrological means.

The current high level of interest and research on the quantized Hall effect led to two strong sessions on activities by the national laboratories to develop resistance standards based thereon. These sessions were kicked off by an invited talk by Toichiro Kinoshita, noted theorist from the Newman Laboratory for Nuclear Studies, Cornell University, who spoke on the anomalous magnetic moment of the electron and the QED-computed determination of the fine structure constant. Eleven contributed papers described quantized Hall effect work in Australia, France, U.K., West Germany, Japan, Canada, Switzerland, BIPM, and the USA.

New and exciting work was presented in five sessions on laser frequency stabilization and time and frequency. Invited talks by John Hall (JILA) and Dr. David Wineland (NBS Time and Frequency Division) covered developments and future prospects in the areas of laser stabilization and frequency standards based on stored ions. Of particular interest among the 18 contributed papers were two on a recent development—cryogenic hydrogen masers. This work was reported by M. D. Huerlimann and his colleagues from the University of British Columbia, and by R. F. C. Vessot and his coworkers from Harvard and the Harvard Smithsonian Center for Astrophysics.

Two of the top researchers in the optoelectronics field gave invited talks in a well attended session. Charles Kao of ITT discussed high frequency limitations of optoelectronic components and Rod Alferness of Bell Laboratories laid out the measurement challenges implicit in making the production of electrooptical devices for telecommunications a reality. Two other sessions dealt with radiometry, and in them the basis for NBS calibration services and radiometry measurements was covered by E. F. Zalewski, J. Geist, and D. McSparron. These sessions represented a "first" for CPEM; in prior conferences only coherent radiation measurements were covered.

In the rf-microwave area, there were also two invited speakers. Eric Griffin of the Royal Signals and Radar Establishment (UK) spoke on recent developments in the use of six-port techniques. Douglas Ryting of Hewlett-Packard discussed microwave measurement challenges. There were seven sessions in this area, one of which was on indepth error analyses of six-port automatic network analyzers with talks given by G. L. Engen, R. M. Judish, C. A. Hoer, and J. R. Juroshek from the NBS Boulder Laboratories.

The dc-low frequency area was most heavily represented with ten sessions in addition to those on quantized Hall effect. Topics covered included power and energy measurements, with an invited talk by Petar Miljanic (Mikhail Pupin Inst., Belgrade); the ac Josephson effect, with an invited talk by J. Niemeyer of PTB, a pioneer in Josephson array work; traditional measurements of resistance and impedance; ac-dc difference measurements; and modern electronic instrumentation.

The academic physics community was unusually well represented. A session entitled "Precision Physical Tests" contained nine papers on the measurement of basic physics parameters such as the determination of the Avogadro constant and fractional charge searches.

The conference closed on Friday with two back-to-back panel sessions. In the first, chaired by Robert Kaarls of the van Swinden Laboratory (Netherlands), the panel members each gave a brief talk on various aspects of determining uncertainties. Emphasis was given to the CIPM recommendations on this topic. This was followed by a discussion with audience participation. Panelists were David Allen and Ron Colle (NBS), Luc Erard (LCIE), Robert Perissi (IMGC), and Kurt Weise and Wolfgang Woeger (PTB).

The technical and economic impacts to be expected as a result of future changes of the as maintained units of voltage and resistance were discussed by the second panel. Members gave the impacts of the changes as seen from the view points of national standards laboratories and European, British, Japanese, and U.S. industry. Whereas prior changes were significant only to the national standardizing laboratories, the magnitude of any future changes to achieve alignment of the units with their SI definitions would be quite large (about 8 ppm in the case of voltage) relative to the specifications of currently available instrumentation. This will create logistics problems throughout the system as a minimum. The general feeling was that any changes should be well thought out and correctly made, with at least a year's prior notice to give ample time for implementation in the calibration community. Panelists were Klaus Jaeger of the National Conference of Standards Laboratories (USA), Volkmar Kose from the PTB (West Germany), Katsunori Shida of the Electro-Technical Laboratory (Japan), A. Douglas Skinner from Marconi Instruments (UK), and Barry Taylor (NBS). The session was chaired by Ernest Ambler, NBS director.

There were 334 registered attendees from 24 countries, 46 percent of them from outside the U.S. Presented in 35 sessions were 165 papers.

The CPEM '86 was chaired by Oskars Petersons; the Conference Digest edited by Ronald F. Dziuba; and the Technical Program Committee was chaired by Norman B. Belecki, all of NBS. William J. M. Moore of NRC (Canada) is editing the Conference Proceedings, which will be a special issue of the IEEE Transactions on Instrumentation and Measurement. Copies of the Digest and Proceedings are available from IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854, Telephone 201–981–0061. The Digest has been assigned publication number 586CH2267-3.

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